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ARTICLE XVI.

REMARKS ON THIRTEEN NEW SPECIES OF CRINOIDEA FROM THE PALÆOZOIC ROCKS OF INDIANA, KENTUCKY, AND OHIO, AND A DESCRIPTION OF CERTAIN PECULIARITIES IN THE STRUCTURE OF THE COLUMNS OF DOLATOCRINUS, AND THEIR ATTACHMENT TO THE BODY OF THE ANIMAL.

BY SIDNEY S. LYON.

Read, February 19, 1869.

THIRTY years have passed away since the collection was commenced which is now the subject of this paper.

The rocks outcropping at the water's edge along the Falls of the Ohio, have become extensively known to geologists and collectors of fossils.

One of these beds has become known as the (Olivanite bed) *Nucleocrinus* bed, or more commonly as the Hickorynut bed. The entire thickness of this bed, in the greatest expansion observed, is about four feet; from this thickness it diminishes to a knife-edge, and at many localities it thins out entirely and disappears.

This horizon is the place of *Nucleocrinus Verneuilli*, *Nucleocrinus angularis*, *Dolatocrinus lucus*, *D. glyptus*, Hall (if the identification made is correct), *Magestocrinus spinusolus*, *Poteriocrinus simplex*, and *Poteriocrinus cylindricus*, *Actinocrinus penta-spinus*, *Actinocrinus multicolorula*, of this paper; also three species referred to a new genus, *HADROCRINUS*, and described in this paper. There have been found three or four other species not identified, probably new.

At the quarries on Bear Grass Creek, Jefferson County, Kentucky, the crinoidal bed above referred to has become quite thin, or has entirely disappeared. Above its place is a bed of hydraulic cement stone, from four to eighteen inches in thickness. At the foot of the Falls of the Ohio, the cement bed has increased in thickness, and it is at this last-named locality about nineteen feet thick.

Succeeding the hydraulic beds is situated a bed of shaly limestone, from six to eight feet thick, containing a large number of crinoidea, but none of those before enumerated have been identified as occurring in it. In this last bed have been observed and identified, *Dolatocrinus Troosti* (*Cocabiocrinus Troosti*), *Dolatocrinus liratus* (*C. liratus*), *Dolato-*

crinus liratus var. *multilira* (*C. l.* var. *multilira*), *Dolatocrinus* var. *intermedius* (*C.* var. *intermedius*), *Ancyrocrinus bulbosus*: all the above are Hall's species. *Enletherocrinus Cassedayi*, *Actinocrinus Cassedayi*, *A. Kentuckyensis* *Cyathocrinus sculptus*, *C. valens*, *C. leviculus*, and others; and several new, or not identified with any description.

Pentremites of the carboniferous type, intermediate between *P. florealis* (*Godoni*) and *P. pyriformis*, Say, are obtained in this bed. These have not been identified.

At the Bear Grass Quarries, where the covering of the lower horizon of crinoideans are separated by the thin layer of hydraulic limestone, there is a partial mingling of the crinoidea of the two beds separated by it. *Nucleocrinus Verneuilli* are found in the upper bed. They are smaller, less robust, and differ very considerably from those obtained in the bed below the hydraulic limestone at the Falls of the Ohio.

From the year 1835 until 1867, fragments from the *Nucleocrinus* beds were added to the collections made from year to year. They were generally parts of crinoidal bodies of large size, pieces of bases, fragments from the middle of the body, fragments of the dome-covering, &c. Until 1867 no specimen revealed the true structure of the calyx of any of the species. No arms or parts of arms have ever been found attached to any of the species. Columns of very large size, short, rapidly tapering from below upward, having many side branches; often found clasping the column or other bodies, are associated with these remains. These are provisionally referred to *H. plenissimus*. They do not belong to any species of *Dolatocrinus*. The column has been found attached to the largest species found in the horizon in which it occurs, and to many of the smaller species of *Dolatocrinus* occurring either in the lower or upper beds; all these are of an entirely different type. In the general form and surface-markings, it most resembles *Dolatocrinus*, associated with it in the same bed. The base of all the species known are deeply excavate. In *Hadrocrinus plenissimus* the basal pieces are entirely hidden under the columnar facet. The first radials, and part of the first radials of the second series, and the interradians of the first series, are deeply implanted in the basal pit, or included within its margin. No specimen that has been observed exhibits the basal pieces, if seen from the outside of the specimen. All fragments, properly cleaned, that contains the base of the animal, will show the structure of the base, seen from the inside.

The first radial pieces are very large. In *H. plenissimus* they differ greatly, both in size and form. They all appear to be ray-bearing. No irregular side, analogous to the *asygos* (anal) side, has been seen in any of the examples observed.

It is no slight matter, in the present condition of our knowledge respecting these animals, to decide what may be differences of structure that have true generic significance. These bodies will not fall into any genera as now defined. The general aspect is different from all known genera and species that have been observed.

It is believed that the differences existing between these and any known crinoidal bodies, are at least of sub-generic importance, even if they are not of greater value. It is therefore proposed that these bodies be classified and distinguished under the generic name of *Hadrocrinus*, and the following generic formula is proposed.

(*Ἀδρὸς*, full grown.)

HADROCRINUS, *n. g.*

Generic Formula.

Basal pieces,	3.
Radial pieces,	1st series, 2×5, first large, second cuneiform.
Radial pieces,	2d series, 2×10, second cuneiform.
Radial pieces,*	3d series, 2×20, " "

Other divisions of the rays advance in series of two.

Interradial fields five, composed of three pieces or more, usually long and narrow. The first resting in the notch between the first radials.

Interbrachial fields two to four pieces or more; irregular; fields differ in different species.

Column round, rough, tapering rapidly, and bearing many branches; opening at top of column round; at some distance below the calyx penultimate. Anal† field. (?)

RADIATA.

ECHINO-DERMATA.

CRINOIDEA.

HADROCRINUS PLENISSIMUS, *n. s.*

Pl. XXVI, Figs. b, b 1, b 2, b 3.

The specimen figured and described is slightly crushed, and does not exhibit the true form. The true form, making due allowance for the crushed condition of the specimen, was low and vase-like; the upper part, above the arms, as shown by other specimens,

* Some species may be found which do not extend to the third bifurcation of the ray-bearing pieces. Our specimen of *H. plenissimus* extends further than the formula. *H. discus* only bifurcates regularly twice. The formula is intended to receive all crinoids with only two ray-pieces in the primary series.

† It is not certain that there is any such difference in the sides of the body as that heretofore called the anal side. The difference spoken of in the size and form of the large first radial pieces, may distinguish the anal side.

gradually rose from the arm-bases about half of the height of the dome; then, more rapidly, about one-third of the height, when the curve of elevation was gradually reversed, and the summit of the dome rounded into a form sub-hemispherical.

The cicatrices, showing the location of the arms, form a closed zone around the calyx at the point of its greatest diameter. In this arrangement of the arms, it resembles *Boto-crinus*. Below the arms, the calyx is depressed vasiform; the base deeply excavate for the reception of the column, which covers and completely conceals the basal pieces. These are not visible from the outside of the specimens, even in the absence of the column.

Basal pieces three in number; when detached from the body present a shallow cup; the interior surface is rounded by the considerable thickness of the pieces, having five angular points, and five concave depressions between them; the spaces which cross the junction of the pieces with each other, being deeper than those upon the ends of the two large basal pieces. The centre of the base has a deep hemispherical depression around, and including the opening between the body and the column; the parts of the basals around this opening are quite thin; the main body of them are remarkable for their thickness. Well-preserved specimens are marked with a leaf-like depression, which originate around the opening, and extend toward, and terminate near the five points of the margin of the base. *First radials*; five in number. Compared with the other pieces forming the body, they are very large, resting on the basals, and extend downward and outward; joined to each other and the base, they form a deep cup. They vary in size, and differ in form: three are hexagonal, the two largest pieces are sub-septagonal—having two angular prominences on the summit of each—the other three are squarely truncated at their superior extremity. The *second radials*, of the first series, are comparatively small. These rest against the square ends of the three smaller first radials, and in the notched space at the summits of the two irregular first radials; they are pentangular, cuneiform, and support, each, two radials of the second series. The second piece of the radials of the second series is also cuneiform, and support each two radials of the third series. The rays are again divided on the second radial of the fourth series. There are other divisions of the radials; these are not sufficiently marked for description. Our specimen probably had eighty rays. It is not improbable that the number of free rays increased with the growth of the animal. Some fragments evidently of the same species as this under consideration, show distinctly the fourth division of the radials upon the body and below the free rays. If the rays bear an equal number of free arms, on the fourth division there would be $5 \times 2 = 10 \times 2 = 20 \times 2 = 40 \times 2 = 80 \times 2 = 160$.*

* Fig. 62, pl. xxvi, was taken from a specimen in the collection of Dr. L. P. Yandell, who, for the purposes of this description, has kindly placed his cabinet at my disposal.

This specimen is figured to show the arrangement and proximity of the arm-bases. If the curve

Interradial fields.—These are five in number, of about seven pieces each. The first piece rests in the angular notch between the first radials; these support two; those two others upon the summit of the third range, in a notch between the pieces, rests the sixth piece of the interradial fields; the sixth supports upon its upper oblique margin a seventh piece, which rests also against the first piece of the second division of the rays. There is some irregularity in this arrangement; some of the interradial fields carry the seventh piece of the field with the double series, and close the series with a single piece; in these cases making eight the number of pieces forming the field.

Interbrachial fields.—Between the first divisions of the ray are placed two pieces, one above the other; they are entirely enclosed by the pieces forming the first and second divisions of the rays. A single piece is placed above the second division of the rays, and is enclosed by the pieces of the second and third division of the radials.

The pieces composing the rays, interradial and interbrachial fields, are nearly equal in size, and are so placed that they form entire zones around the body; nine such zones are apparent in the fragment figured. Other fragments, from portions of the body near the arms, show several more.

The surface of the pieces forming the calyx are variously ornamented, depending upon the condition of the animal at the time it was buried. The best preserved specimens show that the animal had a thick covering different from the bony skeleton, rising in well-defined lines; on this substance are bands of from six to two elevated ridges (most numerous on the pieces near the base), that cross the body in every direction, crossing each other at the centre of the pieces. Near the free rays the bands are reduced in number, and the centre of the subdivisions of the rays are ornamented by an elevated ridge or carina, very thick and high for the size of the pieces which they cover; the summit or back of the carina seems to be plain or level; these ridges are slightly increased in width at the centre of the pieces, which are crossed at right angles to the direction of the rays, by other carina nearly equal in height to the first, and about half as wide as they are. In weathered or worn specimens, that show the naked surface of the bone of the plates, the entire surface of the pieces are covered with a network of fine ridges and depressions, having the general direction of the ridges before described. The ridges frequently bifurcate and close again, filling the surface of the pieces with irregularly-shaped pits or depressions. So varied are the surface-markings growing out of the different conditions of the surface, that were surface-markings relied upon as a specific difference, many species would become necessary for this species.

found in this fragment be carried to a complete circle, one hundred and twenty arm-bases of equal size to those upon it, would be required to fill the circle. Many fragments have been observed that are part of bodies nearly or quite one foot in diameter; this specimen is about four inches in diameter.

Size of Specimen.

	INCHES.
Diameter across at the base of free arms,	5.50
Height (approximately),	2.08
Height to summit of first radials, . . . . .	.60
Diameter at summit of first radials,	1.30
Height of dome above free arms (?),	2.00

Fragment, Different Specimen.

	INCHES.
Height to summit of first radials,	2.50
Diameter at summit of first radials,	2.39

Locality.—Lower crinoid bed, Falls of the Ohio, Clark County, Indiana, one mile below Jeffersonville.

HADROCRINUS DISCUS, *n. s.*

Pl. XXVI, Fig. a.

Our specimen is slightly crushed, but it is manifest that it was low and flat, as the crushing to which it has been subjected has not fractured the plates, and only slightly opened the sutures, where they were united one to another. It was found in place in the rocks, resting on the base, the upper part of the calyx breaking out slightly rounded or nearly level. The general form is that of a flattish dish, to the second bifurcation of the radial pieces, from which it rises rapidly upward and outward the length of two radials, when it again expands more rapidly. The basal pit is excavate, but in our specimen the basal and first radials only are included in it. The second radials of the first series, and the other pieces connected with the first radials, are slightly pressed upward. This is probably due to the pressure to which it had been subjected. The specimen had lost the covering above the arms. All observed fragments of this species showing any part of the dome covering, are flattened. The precise form above the arms is unknown. The amount of displacement of the pieces in our specimen, is proof that it was very slightly convex. The base is hidden under the first radials and the remains of the column, and are relatively smaller than those of *H. plenissimus*. The first radials, five in number, are nearly of the same size and form: hexagonal, squarely truncated above; on the square summit rest five radials of the first series; four are pentangular, the fifth piece is hexagonal. These pieces are cuneiform above, and support two radials each, of the second series, upon their upper oblique margins. The hexagonal second radial of the first series also supports, on its sixth side, one of the interrarial pieces. The first radials of the first division vary greatly in size and form; they are also much larger than the second piece of the first radials im-

mediately beneath them. They are pentagonal, hexagonal, and septagonal. All these forms are found in some one or more of them. Each of these support another radial of the second series. These also vary in form and size: some of them are subquadrangular, others pentagonal or hexagonal. The rays again bifurcate on these pieces, each of which supports two large pieces, some of which are very large. The rays are continued by two large pieces which reach to the base of the free rays.

The *interradial fields* are five in number; they have a general resemblance one to the other, with many special differences. No two of them are exactly alike. The pieces composing them, like those of the rays, vary in size and form. The first piece of these fields rests in the angular notch between the first radial pieces; these are octagonal; four of them support two pieces, and one, the largest of them, supports three pieces of the next series; these again support two arranged irregularly, and are continued by a series of two rows of small pieces. One of the interradial fields show six or eight pieces; the last are very small, long and narrow, probably connecting with the covering—at least reaching to the arm-bases.

Interbrachial fields.—Those seen on our specimen are formed of two or three pieces. Some of them are formed of three pieces, one above the other; the inferior piece resting upon the summit of one of the first radials of the second series, wedged between the adjacent branches of the ray; the upper piece has a square truncation upon the summit, and appears to support one or more narrow pieces. One of these spaces shows this arrangement of the pieces.

Free rays.—The number of the free rays are not absolutely made out. The division of the rays, on the body of the calyx, indicate that each primary ray bears four rays, or twenty rays in all.

The summit, as shown by a fragment (evidently of this species), is covered by very small pieces, slightly convex; arranged irregularly; or, as on some portions of it, around a central piece which supports a short, blunt spine.

Column round; opening unknown.

The surface-markings upon the pieces in our specimens are quite fine or indistinct. Under a strong lens, those pieces upon which the markings are seen, are covered with fine parallel striæ, parallel with the length of the pieces. The pieces composing the rays are deeply pitted near the centre of them by two very distinct pits; the other pieces with a single one. This marking is so peculiar, that a single plate of this species is certainly known and referred to it. The rays can be traced by the double row of pits which mark the pieces composing them.

Well-preserved specimens will, doubtless, show a beautifully-marked species.

<i>Size of Specimen.</i>										INCHES.	
Diameter at the base of free rays,	.	.	.	.	.	.	.	.	.	3.75	
Diameter of pit at summit of first radials,	.	.	.	.	.	.	.	.	.	.70	
Depth of basal pit,	.	.	.	.	.	.	.	.	.	.20	
Height to free rays,	.	.	.	.	.	.	.	.	.	.70	

Locality.—Nucleocrinus bed, Falls of the Ohio, one mile below Jeffersonville.

The arrangement of the arms in groups is somewhat like *Dolatocrinus*. The size of the species is remarkable. In surface-markings it resembles some of the species of *Magestocrinus*, found in the upper crinoidal bed. The plates composing the calyx are very thin, considering the great size of the specimen. It is smaller and less robust than *H. plenissimus*. The many distinct peculiarities of this species will readily serve to distinguish it from all other crinoideans.

HADROCRINUS PENTAGONUS, *n. s.*

Pl. XXVI, Fig. c.

Of this species only a single fragment has been obtained. The specimen consists of the basal, and first and second radials of one ray. It most nearly resembles *H. discus* above. The basalar pit is pentangular; basal pieces quite small; the sides of the first radial pieces diverge slightly, making the sides of the pit very steep; the exterior surface of the first radials are swollen outward near their junction with the pieces above them; are subquadrangular; the truncation of the upper outward corners is very small, producing a very small angular depression between the pieces, at their junction with each other. The upper edges of the first radials are beveled upward and inward. Upon these beveled edges are placed the second radial, in a line nearly at right angles with the column; they are pentangular (the one seen is of this form), cuneiform, narrow, lateral margins nearly parallel with each other, and by their manner of joining the first radial, the spaces between them are nearly or quite as large as the pieces themselves. All the pieces composing the base are remarkable for their stoutness, and for the singular manner by which the second radial is joined to the first.

The surface within the pit is well preserved, and shows the markings on the first radials; the surface of the pieces are corrugated by five irregular, rounded ridges, which cross the pieces, and by a multitude of fine lines (furrows), which cross the ridges at right angles with their length; the furrows between the ridges are smooth. The furrows do not cross them distinctly marked, but gradually fade as they approach them.

The single second radial of the first series is very rough, marked by high, interrupted ridges crossing it toward the centre of the adjoining pieces.

The markings upon the first and second radials separate this from the preceding species. Our specimen is of an individual a little less than *H. discus*. It differs from that species in the pentangular pit, and the more robust character of the plates.

The column appears to have been round, or subpentangular at its junction with the body.

Size of Specimen.

	INCHES.
Greatest length of first radials, . . . . .	.62
Least length of first radials, . . . . .	.47
Height of first radials (vertical), . . . . .	.25
Diameter of base, . . . . .	.37

Locality.—Same as last.

Notice of some Peculiarities in the Structure of Crinoidal Columns, and the Attachment of the Column to the Body of the Animal.

Pl. XXVI, Fig. h.

In a great variety of crinoidal columns, referred to many genera and species, the attachment of the column is by a simple disk, having a plain or crenulated surface at the points of attachment to the body; the disk, by which the column joins the body, being the last joint of the body. Usually the disk is crenulated, varying in the character of the markings with the genera or species to which it belongs; sometimes the marks are only on the margin of the disk; in other species the striæ covers the entire surface of the place by which it attaches to the body; in some the lines are straight, in others wavy or zigzag.

In columns found attached to the bodies of several species of *Dolatocrinus*, the whole structure and arrangement of the superior extremity of the column differs from the forms referred to in a remarkable manner.

In one specimen, in which this variance from the usual form is clearly and distinctly seen, the column is round from a point half an inch below the calyx. In the specimen, the round disks composing this part of the column are about twelve in number, with twelve thin muscular (?) pieces between them,—the number varying with the age of the animal. The round disks, forming the plain part of the column near the calyx, decrease in size, descending about one-half of the pieces, when they increase slightly for the lower portion. On the superior plain disk of the column are placed about ten pieces (varying in number), rapidly increasing in size as they ascend—alternately thick and thin pieces.

The uppermost of these is the largest, expanded at five points around its margin, producing a pentangular piece. The extremity of the angular corners are greatly thickened upward and downward, joined so that the two adjacent, large, thickened pieces completely enclose and cover the thin pieces which lie between them at that point; the smaller and thinner pieces only appearing between the enlarged points of the thick pieces. In very old (matured) specimens the thick and thin pieces are about ten—five of each class. In this case the thick pieces have so increased in thickness as to entirely cover the thin pieces lying between them. Sometimes cases are seen when the thicker pieces have increased to nine. When this is the case, one side of the column has the additional thickened pieces on one side of it. The large pieces then are very thick, and are implanted upon the thin ones, covering, by their breadth, from four to six of them; the thickened edges of the large pieces forming five carina, along the length of the column, above the supplemental pieces.

Below the smooth, rounded disks forming the column, they are alternately thick and thinner. The thick pieces have bosses or enlargements upon them, from three to five each piece, of the same model as those upon the thickened pieces at the upper extremity of the column (not so large as they are, nor so prominent); between these bosses are from two to six much less prominent—straight at the junction of the pieces with each other. The large ones are most prominent in the centre of the thickness of the pieces upon which they are placed.

Between the thick and thinner pieces of this part of the column, are still thinner disks, not seen in an unbroken column; very distinct when the column is separated. This class of disks is supposed to have been muscular, and not bony, or like the larger pieces between which they are placed.

Resting upon the upper joint of the column—the largest piece in the column—are about nine thin disks or zones; the opening of the column, which passes through these, being equal to half the diameter of the largest of these pieces; they diminish gradually in circumference, rounding the pile to a hemispherical form; the upper zone by the opening in the column, and its diminished size, is reduced to a ring about as wide as high. The bottom piece of those composing the hemispherical (*atlas*) at the head of the column, joins the upper piece of the column, the surface of both pieces being sharply crenulated upon the joining surfaces. Surrounding the hemispherical pile of thin pieces at the head of the column, are three (?) or five false basalar pieces. These pieces rise above the top of the pieces of the atlas a distance equal to the thickness of two of the zone-pieces enclosed by them; they terminate upward, in a thin knife-like edge, around the columnar opening; their broad, external faces fitting into the columnar pit, partly sunk in the basal pieces, and partly enclosed by and fitting the external surfaces of the inferior extremity of the

first radials. The inferior extremity of the false basals are about as thick as the width of the lowest zone forming the atlas; they are joined by a crenulated surface to the upper disk of the column, thus completing it in a rounded hemispherical knob, composed of the two sets of pieces described, the whole completely filling the lower part of the depression at the base of the calyx of the animal.

The pieces terminating the column are divided like the true basal pieces; they form a similar cup, not notched, as are the summit of the true basals, but squarely truncated and crenulated at their base, like the pieces composing the column below the body.

The pieces rounding the top of the column are frequently found attached to the body, completely filling the basalar cavity. They can generally be distinguished from the upper flat disk of the column, by the difference in the texture of the two classes of pieces, and are usually seen as two rings, one within the other.

All the deep, basal-pitted *Dolatocrinus* known, are attached to columns, the summits of which are formed in the manner of those described above. No columns of the class described have been found attached to any species of *Hadrocrinus*. The basalar pits, and the rounded indentation in the true basal pieces, are formed in the same manner in *Hadrocrinus* as those of *Dolatocrinus*, to which they have been found attached.

Several species of *Dolatocrinus*, to which this form of the head of the column is known to belong, have the column below the *atlas* formed of alternate broad and narrower disks. The muscular attachments are not so distinctly marked upon the exterior surface of the atlas, as in the large species *D. glyptus* (Hall's species), to which the columns particularly described belongs. No opinion is offered in relation to the particular use of the head of this class of columns of crinoidea.

It is proposed to distinguish the pieces forming the exterior covering of the head of the column, *false basals*; and the whole dome-like termination of the column, the *atlas*.

GENUS ACTINOCRINUS. MILLER, 1821.

(*Nat. Hist. CRINOIDEA.*)

ACTINOCRINUS PENTASPINUS, *n. s.*

Pl. XXVII, Figs. d, d 1.

Body, when divested of the summit covering, sub-cylindrical; slightly contracted beneath the arm-bases; base squarely truncated parallel to the arm-bases; the united basal pieces are pentangular; a little larger than one of the first radials; a piece of the column attached is small and round, formed of circular pieces of variable diameter, the larger pieces thinning from their junction with the smaller ones, and terminating in a sharp edge. The

basal pieces are remarkable for the perfectly level inferior surface, except at the points, which are slightly elevated. The first radials are very large, each bearing near its centre a stout spine, nearly half an inch in length, which is pointed outward and upward. Three of the radials are hexagonal, two subseptagonal—differing slightly in size. Each bears a second radial, of variable size and form: two are pentangular; three subquadrangular; some are plane-surfaced, others are slightly convex. The third radials are very small; differing in size; pentangular; some of them are so short as to appear triangular; these are about five times as wide as high; they support one or two circular or crescent-shaped pieces; these, the bases of the free arms, ten in number. Their form and arrangement are unknown.

From the notch between the sides of the first radial pieces, rise five interradians of the first series, variable in size and form; the largest are hexagonal, the others subquadrangular; they each support two interradians of the second series; different in form and size; small. The third series of interradians are very small; one or two to each field; their upper extremity extending upward between the groups of arm-bases. The arm-bases of each group are quite close to each other, but they appear to have a slim, long piece between them.

The covering of the dome is absent; its form, and the arrangement and character of the pieces covering it, are unknown.

This species, as seen in our example of it, does not show any surface-marking on the plates; they have, no doubt, been lost from our specimen by the loss of the integument which covered their surface.

Size of Specimen.

	INCHES.
Height to free arms, . . . . .	.60
Diameter at free arms, . . . . .	.70
Diameter to end of spines on first radials,	1.50
Diameter of united basal pieces, . . . . .	.40
Diameter of first radials, . . . . .	.35

Locality.—Nucleocrinus or lower crinoid bed, Falls of the Ohio; very rare as good specimens; plates and fragments not rare.

This species has many of the characters of *Dolatocrinus*. It is not nearly related to any known species of *Actinocrinus*, except *A. multicornus*, described in this paper. It will be readily distinguished from all *Actinocrinus*, by the spines, which rise so prominently from the first radial pieces.

ACTINOCRINUS MULTICORNUS, *n. s.*

Pl. XXVI, Fig. e.

The body swells gradually from the arm-bases to the summit of the first radials; then diminishes by a similar curve, to the bottom of the first radials; below this point the body is unknown; the structure or arrangement of the species is nearly identical with *A. pentaspinus*. The arm-bases are not quite so prominent as in that species. The first and second radials, and the first interradials, are all spine-bearing. The spines on all the spine-bearing pieces, are of equal size—short, stout, and pointed. The spines upon the first radials rise less abruptly from the face of the piece than the others; the piece is also more gibbous than the other spine-bearing pieces.

The summit is crushed and the pieces disarranged. Among the disarranged pieces, upon the summit, are some bearing strong spines; nearly of the same form as the spines upon the body. The arms are in groups of two for each ray—ten in all. Their form and arrangement is unknown.

The form is more delicate than *A. pentaspinus*, which it more nearly resembles than any other known species. The points of the spines are not so acute as they are in that species, and none of them are large or long.

Size of Specimen.

	INCHES.
Diameter of body to points of spines, . . . . .	.80
Height to top of arm-bases, . . . . .	.54
Diameter of body, base of spines, . . . . .	.62
Diameter across arm-bases, . . . . .	.60

Locality.—Same as last.

CYATHOCRINUS. MILLER, 1821.

(Nat. Hist. CRINOIDEA.)

CYATHOCRINUS RARUS, *n. s.*

Pl. XXVII, Figs. i, i 1.

Only two specimens of this unique species have been observed; both crushed, and the parts thrown, more or less, out of their true relations to each other. The markings, or ornament of the plates, are very prominent, giving a rough appearance to the body. Our specimens show parts of three rays. The first ray-bearing pieces support, each, two free rays; these are again divided on the second piece ascending. This arrangement gives

twenty free rays on the second division of the arms. The ray-pieces, which form the base of the second division, each bear a short, blunt spine.

The pieces composing the body are too much disarranged to exhibit their true relations to each other. The basal pieces have a very prominent protuberance rising near the centre of each. One of the pieces forming the ring of the basals, is much larger than the others; this piece bears no prominent knob; its surface is nearly level. The raised bands, crossing the plates, consist of from two to three parallel ridges. All these pieces are covered with granules of irregular size.

The column is very large and strong for so small a body; it is composed of regular, round disks, placed in the column; alternately one large, and then smaller ones; the middle one of the three being larger than the two others; the largest size pieces are quite thick, compared with the thinner ones between them. The column has a uniform size for about three inches below the body, when it diminishes rapidly toward the lower extremity. In the smaller specimen figured, the column has nearly reached a point in four inches. The extremity of the column has been lost in both of the examples.

The smaller specimen appears to have been a free floating body, like *Woodocrinus macrodactylus*, and some species of *Glyptocrinus*; at least at some period during its growth.

Size of Specimen (approximately).

	INCHES.
Diameter of base, . . . . .	.26
Height of base, . . . . .	.15
Height of first radials, . . . . .	.51
Diameter at top of first radials, . . . . .	.55
Diameter of column near base, . . . . .	.20

Locality and Geological Position.—Nucleocrinus bed, near mill, Falls of the Ohio, Clark County, Indiana.

Fragments are frequently met with; good examples are very rare.

No Cyathocrinus, with which I am acquainted, is nearly related to this species. Plates and fragments of an undescribed, analogous species, is found at Buttonmould Knob, Jefferson County, Kentucky. They belong to a larger species, and are more delicately ornamented than our species.

The Buttonmould Knob locality is situated about one hundred feet above the top of the black slate, and has been referred to the subcarboniferous division of the rocks of Kentucky and Indiana, by those well qualified to give opinions upon this subject.

CYATHOCRINUS INSUPERATUS, *n. s.*

Pl. XXVII, Fig. k.

The body below the free rays is nearly as wide as high—obconical in form; above the free rays the proboscis is greatly expanded, being nearly as wide, and longer than the body below. The proboscis, or rather, sack, is composed of several rows of large pieces, one above another; hexagonal; longer than high. The ends of the pieces are equally truncated on both sides, forming a sharp angular point, by which the rows are joined; the pieces in adjacent rows alternating one above the other of those in the adjoining rows.

The plates of the calyx are very thin; basal pieces long; the first radials, subradials, and the two first anal pieces are nearly equal in size. The arms are long; very small; bifurcate on the summit of the second small first radial; giving off additional branches on the third piece above the branch below, three or four times. These branches also bifurcate. The precise arrangement of these branches is not clearly made out, owing to the condition of our specimen. The free rays do not appear to have been provided with pinula; they are round, composed of a single row of short pieces, nearly of equal size.

Size of Specimen.

	INCHES.
Diameter of body at base of free rays, . . . . .	.25
Height to free rays, . . . . .	.27
Height of sack above second anal piece, . . . . .	.50
Diameter of sack, . . . . .	.35 to .40
Length of free rays, . . . . .	.45 to .50

Locality and Geological Position.—Crawfordsville, Montgomery County, Indiana. It occurs not abundantly in the silicious sandstones of the knob formation—*Safford's silicious* group—at the base of the subcarboniferous limestone. In some beds of these measures the fine mud has swept into the locality of the crinoidea, apparently burying them alive. These bodies are attached to the columns; all extended one way; the fingers unbroken, and the most delicate parts preserved in the now consolidated mud. The bodies have decayed, and left perfect moulds of the animals in the soft rock, to mark the place of their burial. In some of the beds water has carried lime, in solution, into these cavities; these are now filled with crystallized lime. Remarkable specimens of the empty moulds of crinoids are abundant.

Remarks.—Our specimens are attached to a block of stone, and somewhat distorted by crushing. The measurements are only approximately correct.

This species will be readily separated from *C. rotundus*, Hall, which it most nearly resembles, by the length and expansion of the proboscis, the greater length of the basal pieces, and the marked difference in the character of the pieces composing the arms. In

that species these pieces are about three times as long as their thickness; in our species their length is about equal to their diameter.

POTERIOCRINUS. MILLER, 1821.

(*Nat. Hist. CRINOIDEA.*)

POTERIOCRINUS SIMPLEX, *n. s.*

Pl. XXVI, Fig. f.

Body conical, long and slim; basal pieces long and thin; subradials and two of the radials nearly of equal length; the pieces gradually increasing in width as they rise in the calyx. In our specimen the anal side is presented; it consists of about five pieces; the first is nearly as large as the first radials, and supports two long pieces a little smaller; all the pieces are slightly gibbous; sutures at the junction of the pieces strongly marked by the depression formed by the sides of the plates. The pieces are very thick; cavity of the body small; arms and summit unknown; column round, rapidly tapering from the body downward, formed of circular disks of equal thickness. The surface of our specimen is smooth, showing no markings.

Size of Specimen.

	INCHES.
Length of calyx to top of second radials, . . . . .	.32
Diameter at summit of second radials, . . . . .	.22
Diameter of base at top of column, . . . . .	.15

Locality and Geological Position.—Nucleocrinus or lower crinoid bed, near mill, on the Falls of the Ohio.

This species is longer and thinner than any species observed; approaches *P. rhenanus*, F. A. Roemer, nearer than any other, and the form, the number, and arrangement of the pieces in the anal field.

POTERIOCRINUS CYLINDRICUS, *n. s.*

Pl. XXVII, Figs. 1, 1 1.

Body, from base to the free rays, cylindrical; abruptly rounded on the basal pieces; basal pieces short and thick, forming a low broad cup; radial pieces short; two of them, that are complete, reach the second radial; this is also quite short, and appears to bear a third radial, also short; it reaches to the base of the free rays; arms unknown. The dome, or proboscis, in our specimen, is crushed; its form is not known; the loose, disarranged

pieces indicate that it was covered by small spine-bearing plates. Column round; formed of disks of unequal size. Near the body they are arranged by two small and two larger pieces, and by a piece much larger than those above it. This arrangement is repeated seven or eight times in our specimen, with some irregularity in the size and thickness of the pieces. The column is quite large, when compared with the body it supports. Some of the pieces of the body are covered by very fine granules, placed quite close together.

Size of Specimen.

	INCHES.
Length of body to free rays, . . . . .	.40
Diameter to summit of first radials, . . . . .	.22
Length of remains of proboscis, . . . . .	.55
Diameter of column, large pieces, . . . . .	.15

Locality and Geological Position.—Nucleocrinus bed, Falls of the Ohio, near the mill. Fragments are not rare; good specimens very rare.

The flattened base gives this species the general appearance of *Platycrinus*. It terminates more abruptly at the column than any other *Potinocrinus* that has come under my observation.

PLATYCRINUS. MILLER, 1821.

(*Nat. Hist.* CRINOIDEA.)

PLATYCRINUS LEAI, *n. s.**

Pl. XXVI, Fig. g, g 1.

Body, below the arm-bases, turbinate; smooth; slightly expanded at the junction with the column. The centre of the upper margin of the first radials expanded, forming on each, projections like the lip of a pitcher. Basal pieces three, of equal size; pentangular, forming a cup, equally divided at its upper margin into six slightly concave depressions, for the reception of the first radial pieces. First radials, six in number; subquadrangular; a little higher than wide; a slight, but distinctly defined, smooth ridge, occupies the centre of the first radials, extending from the basals to the lip-like projection, on which are placed the second radials. The ridges upon three of the first radial pieces continue downward along sutures, at which the vertical sides of the basals are united to the swollen part of the basal pieces, with which they unite and are lost in it. The second

* This species is dedicated to that able and earnest servant of the Natural Sciences, Isaac Lea, LL.D., of Philadelphia, Pennsylvania.

radials are very small; four times as broad as high. The third radials are larger than the second; flat; cuneiform; very low, or short on their vertical margin; each of these support the first piece, or the base of the free rays. The free rays rise singly, one on each radial series; they are composed of rather large, thin, semicircular pieces, which abut squarely against each other at the centre of the back of the rays; the pieces of the ray do not interlock with each other, so far as they are preserved on the examples observed. No part of the dome is attached to any specimen seen; its form and arrangement is unknown. All the plates of the body are very thin, except near the attachment to the column and the arms.

Column round, composed of circular pieces; the smaller ones are about three times as thick as the larger pieces. The pieces are alternately disposed, thicker and thin ones. The thin pieces are enormously expanded; some have been observed surrounding a small one—two-twentieths of an inch in diameter—that were nearly an inch in diameter, of a thickness not greatly exceeding one hundred to the inch, the enlarged pieces still retaining their perfectly circular outline. These rounded, disk pieces, surrounding a small columnar piece, was for many years a mystery; their connection could not be traced to any known crinoidal body until the discovery of the specimen figured, Plate II, Fig. g 1, showed their connection with *Platycrinus Leai*, of this paper.

Size of Specimen.

	INCHES.
Height of basal cup, . . . . .	.27
Height to summit of first radials, . . . . .	.70
Diameter at summit of first radials, . . . . .	.97
Diameter of columnar facet, . . . . .	.20
Height of second and third radial pieces, . . . . .	.12
Width of third radial pieces, . . . . .	.22

Locality and Geological Position.—Upper crinoideal limestone, Bear Grass Quarries, Jefferson County, Kentucky. Fragments abundant; good specimens very rare. The epidermis, or muscular covering, which no doubt in life covered all crinoideans, and upon which the ornamentation found on so great a number of these bodies, in such exquisite beauty and variety, is placed, does not appear to have been preserved on any fragment of the specimens recovered. Under a strong lens, obscure striæ are observed on some parts of some of the larger plates.

The rocks of this locality, which are of great thickness in New York, in the geological horizon immediately above the Niagara group, are here quite thin; and there is a mingling in these beds of the fossils of the Niagara, Upper and Lower Hilderburgh, &c., to the base of the black slate.* The entire thickness of these beds, at localities where the

* *Genesee slate.* See Vol. II, Illinois Reports, Introduction, p. 8.

hydraulic limestone is thinnest, being about twenty feet. Several specimens, *Halsytes escaroides*, have been obtained within eight feet of the base of the slate.

NOTE.—It is with some hesitation that *P. Leai* is referred to *Platycrinus*. Our description will show that it possesses characteristics that ought to exclude it from *Platycrinus*. It also differs from *Hexacrinus*, *Austin*, and probably possesses characters of at least sub-generic value, by which it may be separated from other *Platocrinoid* forms.

NOTE.—Since the above description was written, Dr. Knapp, of Louisville, Kentucky, has kindly furnished me with several examples of *P. Leai*. They vary in size; some of them are shorter, others longer than those figured. One of the specimens retains the epidermis upon two of the large radials, and one of the basal pieces. The surface-markings on these consist of a finely granulose surface, invisible to the unaided eye; upon this granulose surface are lines of larger granules, about one-twentieth of an inch apart. The lines are not regular; they appear to start at the base of the large radials; converging, meet at the centre of the radials; those starting from the corners of the pieces meeting at the arm-bases; those above, on either side, parallel to the longest line below them.

GENUS DOLATOCRINUS. LYON, 1857.

KY. GEOL. REPORTS, VOL. III.

DOLATOCRINUS MARSHI, *n. s.*

Pl. XXVII, Figs. n, n 1, n 2.

Body, below the arms, discoid, with five broad, sharp carina, which rise perpendicularly from the margin of the basal pit, and extend outward, equally elevated to the centre of the third radials, the carina rising gradually from the margins of the radials, then more rapidly to the centre of the pieces. At the centre of the third radials the carina sends out branches, not quite so bold as the main stem, but strong, involving all the pieces of the superradials up to the arm-bases. Arm-bases prominent, in groups of two to each ray, producing a lobed, pentagonal figure of that section of the body. The dome is sub-conical; twice as high as the body below the arms; surmounted by a thick, strong, sub-central proboscis. The interrarial fields unite to the dome-covering between the arms. Basal pieces long; bending squarely (at right angles) into the basal pit; six-sided; the upper part (not concealed in the pit) horizontally disposed. Second radial pieces sub-quadrangular; differing slightly in size. Third radial pieces pentangular; varying in form and size. The first, second, and third radial pieces of the several rays, differ very little in length, in the same ray—the rays are of variable length. The third radials each support two superradials, nearly as large as the ray-pieces below them. These support, some one, others two superradial pieces beneath the arm-bases. Basal pit: this is filled by the “*atlas*” of a column, such as that described in this paper. Its depth is not seen. Two

less perfect specimens than that figured, exhibit the basal pit close and less deep than *D. lacus* and several others; the sides rising nearly perpendicularly with the base of the body. The “*atlas*” is seen in the figure (n, Pl. XXVII), surrounded by the false basals, which form the outer ring within the basal pit. The basals, as is usual in examples of this genus, are hidden by the first radials.

Interradial fields.—These are five in number. The pieces composing the several fields vary in number, from seven to nine to each field. The first is large, subvoid; nine-sided; a little larger than any other pieces of the calyx. Upon the upper margin of these rest another large piece, equal in size to the radial pieces; they differ in form, but are all six-sided. Upon the upper margins of these rest three interradials of the third series, except in one field, where there are only two of these pieces, the third side supporting one of the superradials. The fourth series consists of two to each field, except one, which has four pieces in the fourth range of the interradial field. The fourth range supports two pieces to each field; the upper end of these are joined to the points of the long pieces which lie between the lobes on the dome.

Interbrachials.—From two to four to a field, and are wedged between the arm-bases; when of four pieces, they are in pairs, one above the other. The dome is covered by large pieces; each field between the lobes contain a pair of the largest, which reach from the arm-bases toward the proboscis; they are six or seven-sided; long; broadest at the upper extremity; pointed, or very slightly truncated at the lower end; joining each other by their longest sides, at the centre of the depression between the lobes. A circle of large pieces surround the dome; all of these rest partly upon the ten long pieces. The pieces composing this zone are of different sizes; they also differ in form; all six-sided; two of the largest pieces of the circle rest directly over two of the long pieces; three other groups of the long pieces unite under the suture, uniting two of the pieces forming the circle, so that the sutures uniting both sets of pieces, form one line from the arm-bases to the base of the second circle surrounding the dome near the base of the proboscis. The specimen figured has the proboscis broken off through the pieces of the second zone which surround it. Below the zone described, and between the groups of long pieces, are groups of from five to seven pieces, the upper one of which is joined to the circle above the group of long pieces, and on which it rests. The lowest piece of these groups is lanceolate; is lodged between the arm-bases, and unites with the interbrachials. The upper and largest piece of these several groups is of the same size and form as the pieces comprising the first zone around the top of the dome. Around the arm-bases, the pieces are numerous and quite small. The pieces comprising the lower zone, and the large ones of the groups above the arms, are surmounted by a group of from three to five rough, pointed spines, confluent near their bases. The fragments of the second zone, remaining at the base of

the proboscis, are ornamented by three or more hemispherical tubercles, differing in size, irregularly disposed across the pieces. All the other pieces of the dome are gibbous or concave, and not ornamented. In better preserved specimens, it is probable that the whole surface of the dome will be found covered with fine granules.

All the pieces of the body below the arms are covered with fine ridges, disposed in groups, radiating from the centre of the pieces; on the radials, and larger pieces, these number from six to ten in each group; thus the margins of the first interradians are ornamented by about seventy of these ridges. Column and arms unknown.

Size of Specimen.

	INCHES.
Height of body below the arm-bases, . . . . .	.36
Height of dome to base of proboscis, . . . . .	.67
Height of whole body,	1.03
Diameter of calyx at arm-bases,	1.37
Diameter of base of proboscis, . . . . .	.46
Diameter of basal pit, . . . . .	.30

Locality and Geological Position.—Nucleocrinus bed, or lower crinoid bed, Falls of the Ohio, Clark County, Indiana. Very rare. The specimen figured is of an adult, unusually large for this species.

A few years ago a crinoidal body was received in exchange, from a friend, having a label attached, "Collected near Dayton, Ohio."

This fossil attracted considerable attention; its anomalous structure, and general appearance, separated it from all crinoids that had come under my observation.

In the year 1860 a drawing was made of it, preparatory to description. The troubled condition of the country at the time, and during the war, delayed the paper describing it. I now propose a description of it, and to erect a new genus for its reception, and other similar forms, under the name of *Ataxiacrinus* (*Αταξια*), irregular; and the following generic formula is submitted.

ATAXIACRINUS, n. g.

Generic Formula.

Basal pieces, 5.

Radial pieces of the first series in three rays, 1 to each ray to the free arms.

Radial pieces of the first series in two rays, 2 to the free rays.

Supplementary radials to the rays with two radials, 1.

All the free rays, and supplementary radials, arm-bearing.

Dome covered by many small pieces.

Anal pieces. (?)

Column subpentagonal; opening pentelobate.

Arms unknown.

ATAXIACRINUS CAPONIFORMIS, *n. s.*

Pl. XXVII, Figs. o, o 1, o 2, o 3.

Body flat; discoid below the arms; nearly flat on the dome.* Basal pieces five; five-sided, and united they form a pentagonal piece, the sides of which are nearly equal; the pentelobate opening into the column from the body notching the base of the pieces of the base. The radial piece on the left of Fig. o 2, Plate XXVII, and on the right of Figs. o and o 1, is much the largest piece in the body; is seven-sided, and about half its length is curved over upon the dome, nearly three times as wide as the distance from the ends of the basals to the base of the free rays, which rest upon it. On both vertical sides of the largest piece is placed one subquadrangular piece, the first of the two irregular rays; upon these rest the second radial pieces; that upon the ray (Fig. o, Plate XXVII), is much larger than that upon the opposite irregular ray; it is hexagonal in form, and much like the largest piece, and the largest first radials of the other rays. Both of the second radials in the irregular rays, support, each, one supplementary radial, and the base of one of the free rays. The supplementary radials are placed one upon the left side of the ray (Fig. o, Plate XXVII), and is a larger piece than that upon the left side of the opposite ray. The other two first radials, those on the right (Fig. o 2, Plate XXVII) and the left (Fig. o 1) are nearly of the same size, of similar form to the largest radial; like that they curve over the upper surface of the dome. All of the upper radials, except one which carries (on our specimen) a small subquadrangular piece of one of the free rays, show openings into the body. This one is crushed upon, and probably conceals it. Both of the supplementary radials carry a small fragment (supposed to be) of ray pieces. They appear to be solid (?), and not open as in the regular ray pieces. The pieces covering the dome are small and slightly gibbous, and arranged without any apparent order. No oral opening can be perceived.

The form of the arms, and their arrangement, is unknown.

The column is composed of rather thick disks, placed one upon the other, with a thin, muscular disk between them; they are all pentelobate. A groove lies between the rounded corners of the pieces, which form the column. The thick pieces of the column between the grooves have a depression in their edges, about half the length of the space between the grooves.

* The specimen is slightly crushed, bending toward each other the irregular rays; producing, by the crushing, several wrinkles on the dome-cover, and pushing it upward. The remains of the free rays on the irregular rays project upward, producing a figure not unlike a dressed capon. The species is described as if our specimen had not been distorted.

Columnar opening in all parts of the column is of the same form in all its sections, when broken, as that penetrating the body through the basal pieces.

The surface of the calyx, below the free rays, irregularly granulose.

Size of Specimen.

	INCHES.
Greatest diameter,	1.36
Vertical height to free rays on the largest piece, . . . . .	.44
Vertical height to the free arms on longest ray, . . . . .	.77
Diameter of columnar facet, . . . . .	.30
Greatest diameter of basal pieces united, . . . . .	.78

This species will be readily distinguished from all known crinoidea.

GENUS *ZEACRINUS*.* *Troost*.

Synon. *CUPRESSOCRINUS* (sp.), McCoy, 1849. Ann. Mag. Nat. Hist., 2d Ser., Vol. II, p. 224. Not Gold., 1832.

POTERIOCRINUS (sp.), de Koninck and Lehon, 1854. Recherch. Crinoides, p. 91, and of some others.

HYDREIOCRINUS (sp.), de Koninck, 1858. Bull. Acad. Royale Belgique, 2d Ser., t. iii, p. 19.

ZEACRINUS (Troost), Hall, 1858. Iowa Report, Vol. I, Part 2d, p. 541.

ZEACRINUS STIMPSONI, *n. s.*

Pl. XXVII, Figs. m, m 1.

Body sub-cylindrical; slightly constricted at the summit of the subradial plates; composed of plates covered closely with fine granules; centre of subradial plates gibbous; base small; hidden by the column; depression at the base broad, extending to the centre of the subradials, which are nearly of equal size, that under the anal field being the largest; it is six-sided; the five other pieces of the subradials are five-sided; about three times as long as wide; sharply curved at the margin of the basal pit. First radials nearly as long as wide; squarely truncated for the reception of the second radials; angular below; deeply interlocked between the subradials; the lower part prominent as high as the upper extremity of the subradials; deeply depressed midway between the summits of the subradials and the base of the second radials; at their junction with the second radials enlarged, forming a lip or ridge along the suture between them and the second radial pieces. Second radials, five; lanceolate; about as wide as high; five-sided; vertical sides very short, full or ridged along the centre of the pieces; margins prominent; deeply depressed toward the

* The synonymy of the genus above is extracted from Reports of Geological Survey of Illinois, Vol. II, p. 185.

vertical sides from the central ridge. Each second radial bears two pieces of the free rays. The rays again divide on the sixth piece above the second radials. The pieces forming the rays are very rough, having a raised angular rib along the back of each, the direction of which is alternately to the left and right, on the pieces forming the rays one above the other. Each ray-piece bears two prism-shaped pinulæ, not quite opposite to each other, but alternately one a little above the other, one of the angular corners of the prism forming the back of the pinulæ. The junction of the rays with the pinulæ is marked by a prominent, triangular protuberance upon the ray-pieces immediately above the junction of the pinulæ with it. There are about twenty-six ossiculæ in each ray, and any one of its branches. All the rays are equal. The ridges on the ray-pieces, with the angular pinulæ, and the zigzag arrangement of the ray-pieces, gives a very rough appearance to the body above the calyx.

Anal pieces: three are made out distinctly; the largest rests against the right side of the subradial; it is five-sided, angular at the summit, resting between two subradial pieces, and supports one large and one smaller anal piece of the second series, the smallest of which rests on the summit of the left subradial.

Proboscis: since the drawing was made (Plate XXVII, m and m 1) I have removed part of one of the branches of the ray (Fig. m), and uncovered between the main branches of the ray down to the anal pieces, thus exposing to view a proboscis reaching nearly to the top of the Fig. m. It is composed of a series of rather large pieces, in two adjacent rows, interlocking with each other by angular points at the ends of the pieces. The pieces are marked by prominent ridges, most strongly developed at their margins; composed of about five rows of pieces.

Column round, covering the basal pieces, which are unknown.

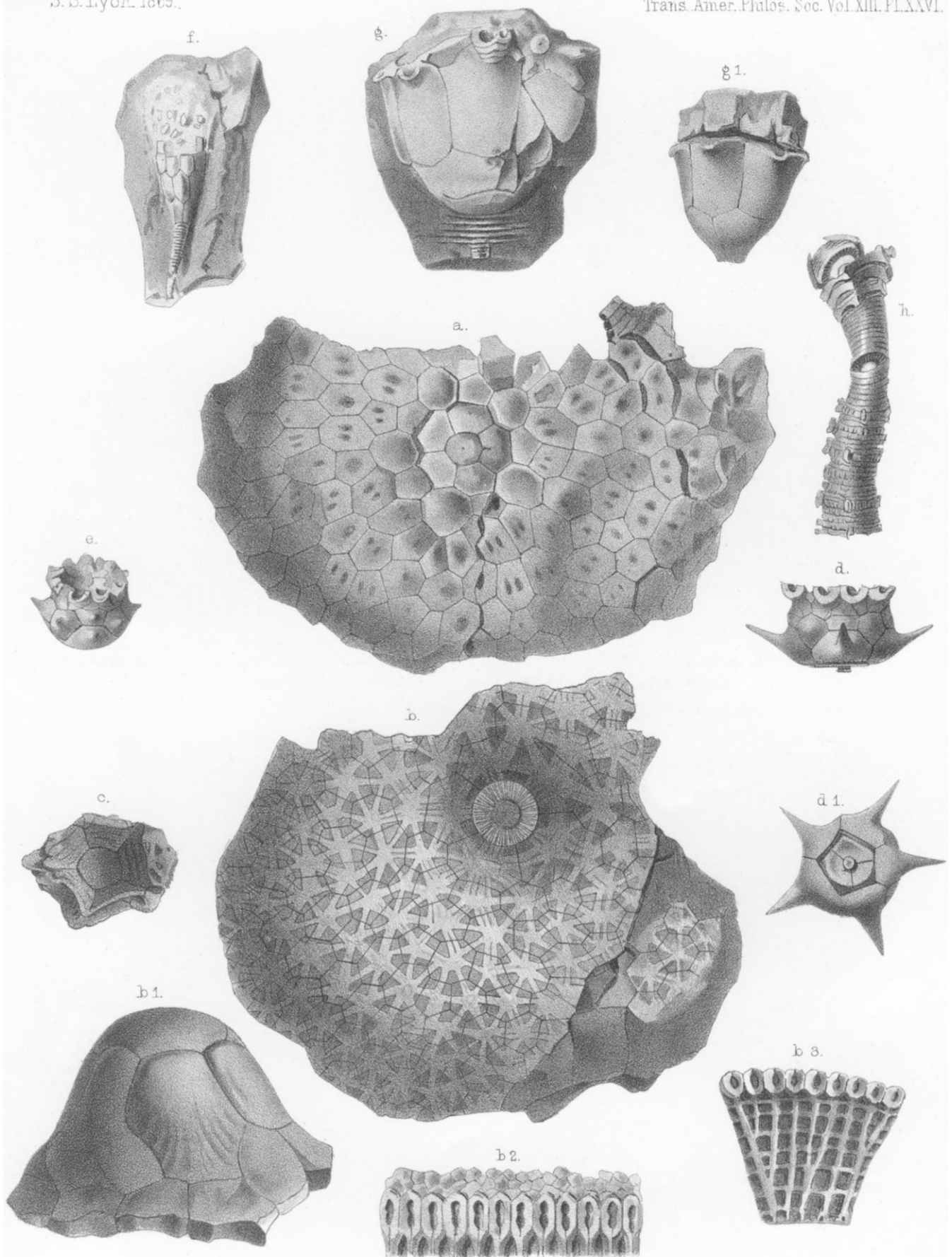
Size of Specimen.

	INCHES.
Length of specimen,	1.32
Height of calyx, . . . . .	.34
Diameter of calyx (approximately), . . . . .	.42
Length of free rays to first bifurcation, . . . . .	.42

Locality and Position.—Found in sandy mud-stones, near the upper part of Safford's silicious group of the subcarboniferous rocks. It is rather rare. Our specimen is crushed.

PLATE I.

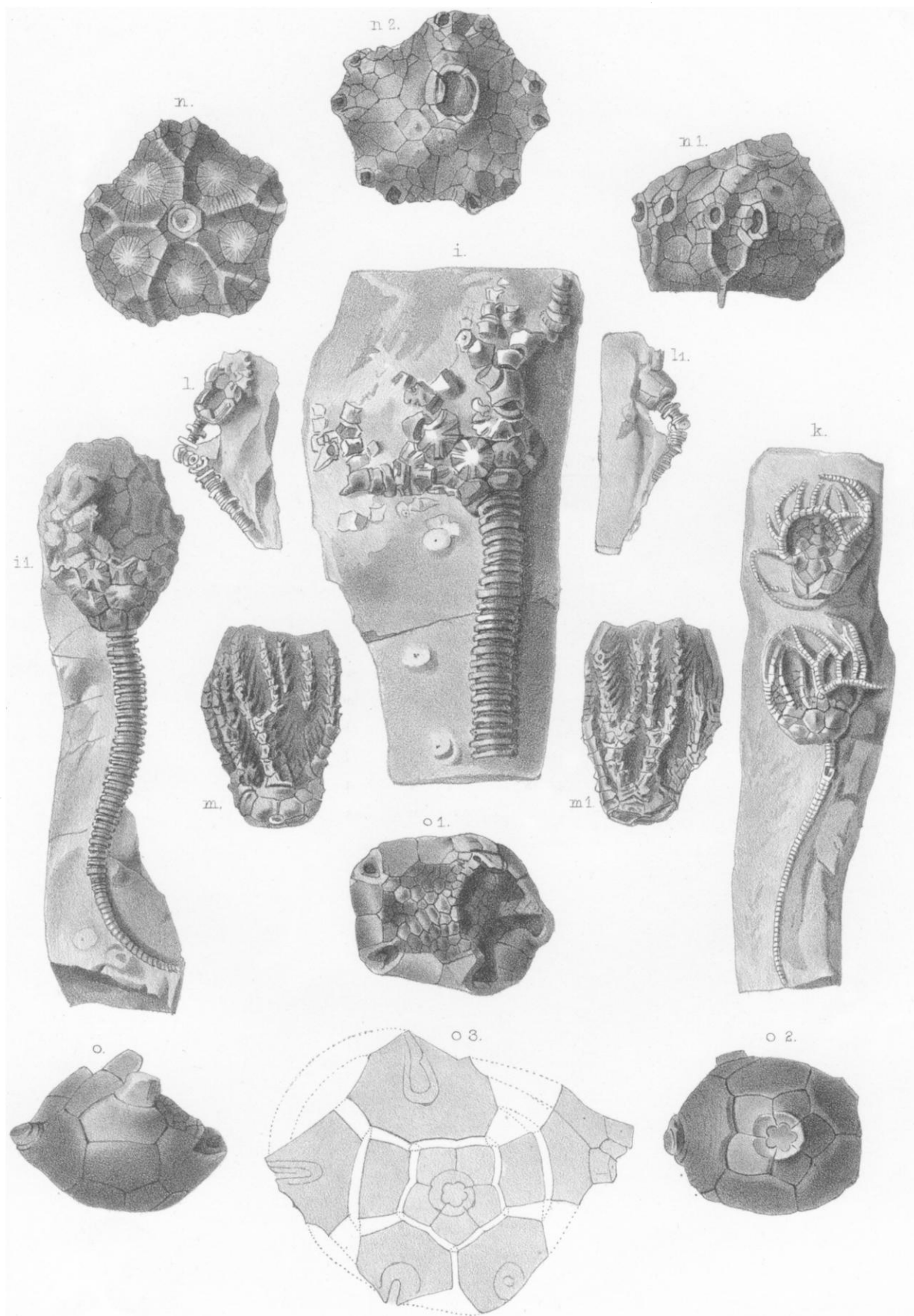
- f.* POTERIOCRINUS SIMPLEX. N. S.
- g—g* 1. PLATYCRINUS LEAI. N. S.
- a.* HADROCRINUS DISCUS. N. S.
- b.* HADROCRINUS PLENISSIMUS. N. S.
- b.* 1. HADROCRINUS PLENISSIMUS. Base seen from the inside of the animal, twice the diameter of the base of *a.*
- b.* 2. HADROCRINUS PLENISSIMUS. Arm bases. Fragment of an individual four and a half inches in diameter.
- b.* 3. HADROCRINUS PLENISSIMUS. Fragment of a specimen three inches in diameter, showing seven (7) ranges of plates below the arms.
- c.* HADROCRINUS ANGULARIS. N. S.
- d.* 1. ACTINOCRINUS PENTASPINA. N. S. Profile.
- d.* ACTINOCRINUS PENTASPINA. N. S. Basal view.
- e.* ACTINOCRINUS MULTACORNU. N. S.
- h.* Column of "*Dolatocrinus.*"



CRINOIDS OF KENTUCKY AND INDIANA.

PLATE II.

- i.* CYATHOCRINUS RARUS. N. S.
- i.* 1. CYATHOCRINUS RARUS. Different specimen.
- k.* CYATHOCRINUS TENUIBRACHIATUS. N. S.
- l.* POTERIOCRINUS CYLINDRICUS. N. S.
- l.* 1. POTERIOCRINUS CYLINDRICUS. Reverse same specimen.
- m.* ZEACRINUS STIMPSONI. N. S.
- m.* 1. ZEACRINUS STIMPSONI. Reverse.
- n.* DOLATOCRINUS MARSHI. N. S. Basal view.
- n.* 1. DOLATOCRINUS MARSHI. Profile view.
- n.* 2. DOLATOCRINUS MARSHI. Summit view.
- o.* ATAXIACRINUS CAPONIFORMIS. N. S. Profile view.
- o.* 1. ATAXIACRINUS CAPONIFORMIS. Summit view.
- o.* 2. ATAXIACRINUS CAPONIFORMIS. Basal view.
- o.* 3. ATAXIACRINUS. Generic diagram.



CRINOIDS OF KENTUCKY AND INDIANA.